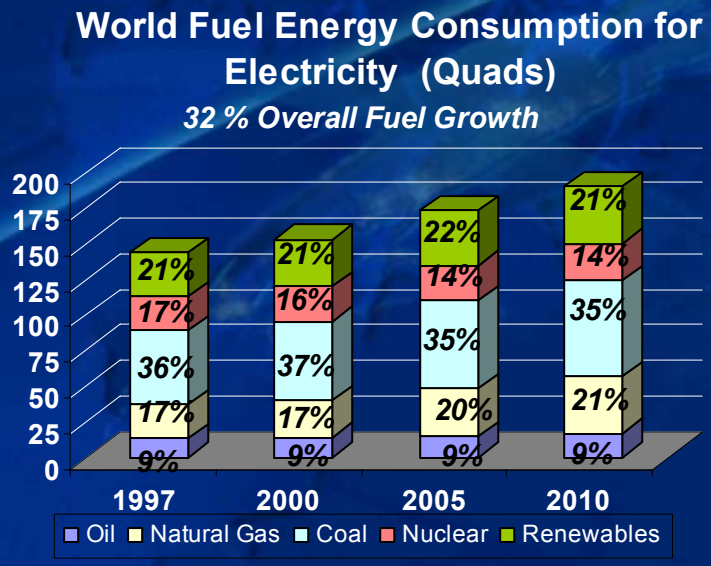
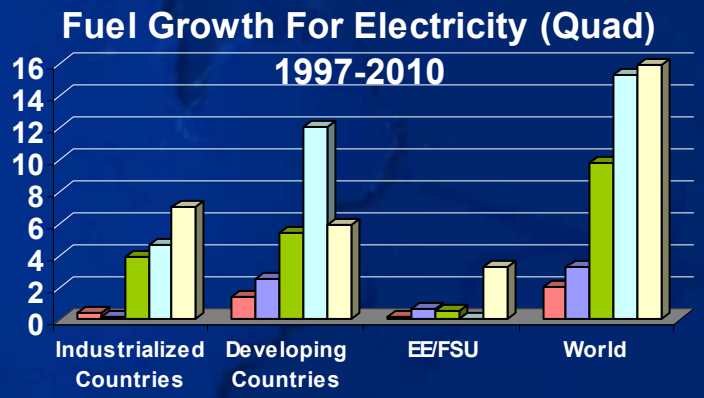
Coal Technology Needed by the US Power Market

What is the Future for Coal ?





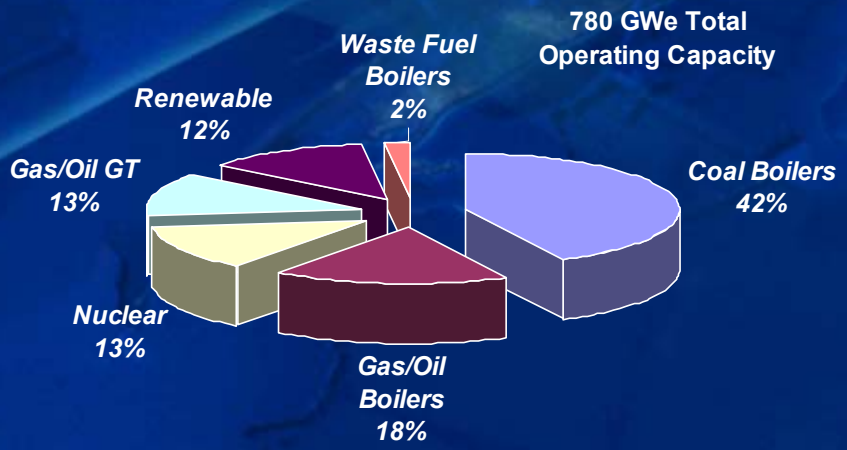
- High Growth in Developing Countries Driven By Power Demand, Abundant Coal and Low Environmental Concern
- Stagnant Growth in Industrialized Countries Driven Primarily by Environmental Concern
- Revitalizing Coal Growth in Industrialized Countries are key to unlocking Coal's Long Term Growth Potential

Environmental Concern is the Greatest Limiting Factor to Coal's Future

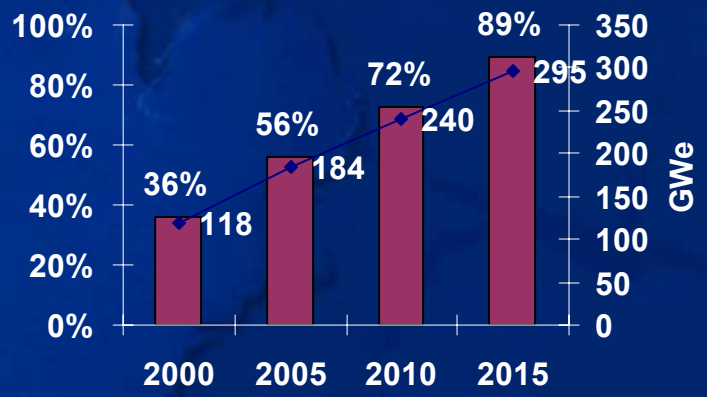
Source: International Energy Outlook, EIA, 2000

The U.S. Power Generation Fleet

Existing US Power Fleet



Coal Plants Over 30 Design Year Life

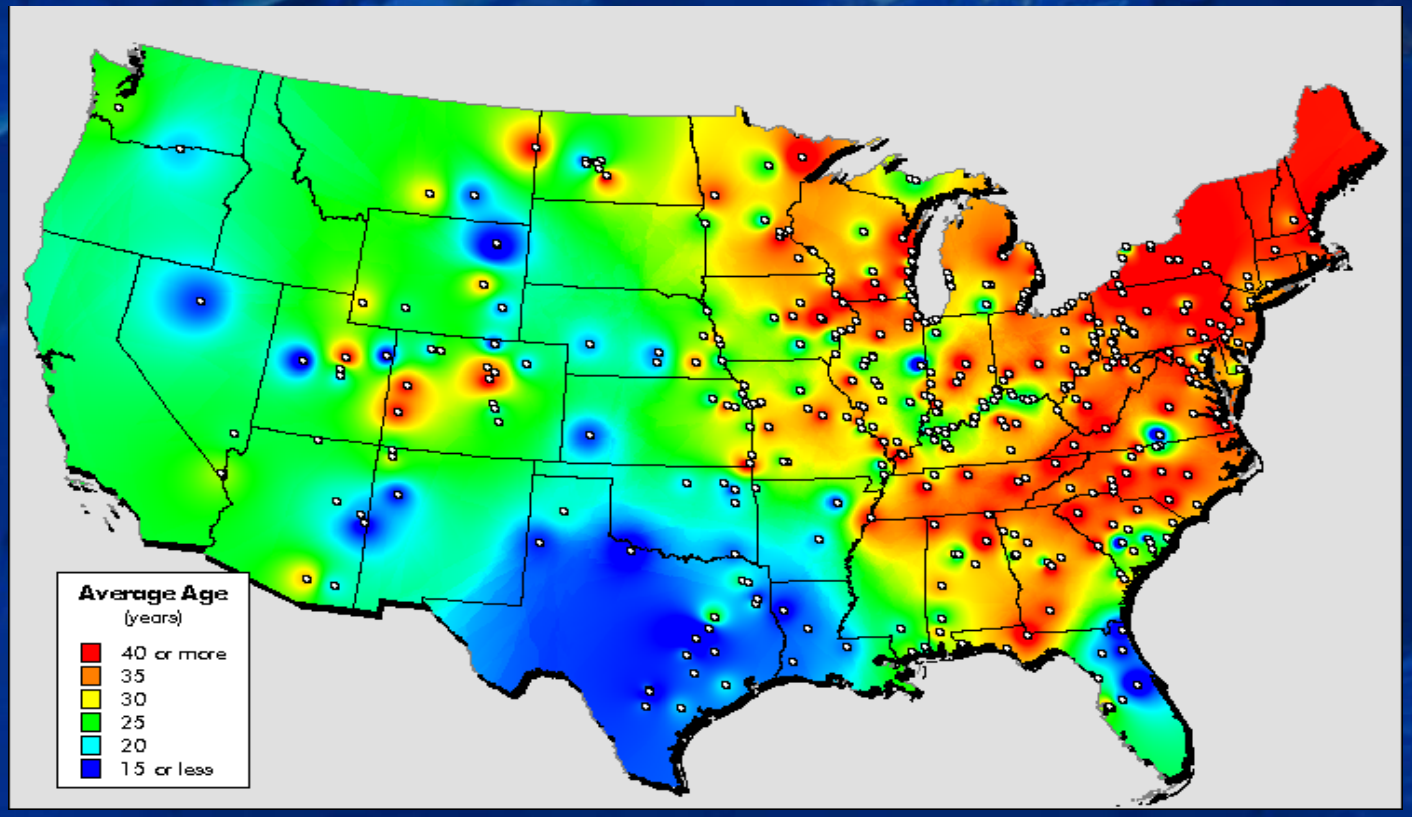


- New Gas Capacity Aimed at Filling Short Term Supply Problem
- But Bigger Long-Term Capacity Problem is Evident
  - Most US Power Comes from Coal (51%)
  - Many are Emitting Well Above NSPS
  - Aging Fleet

Clean Coal is the Solution

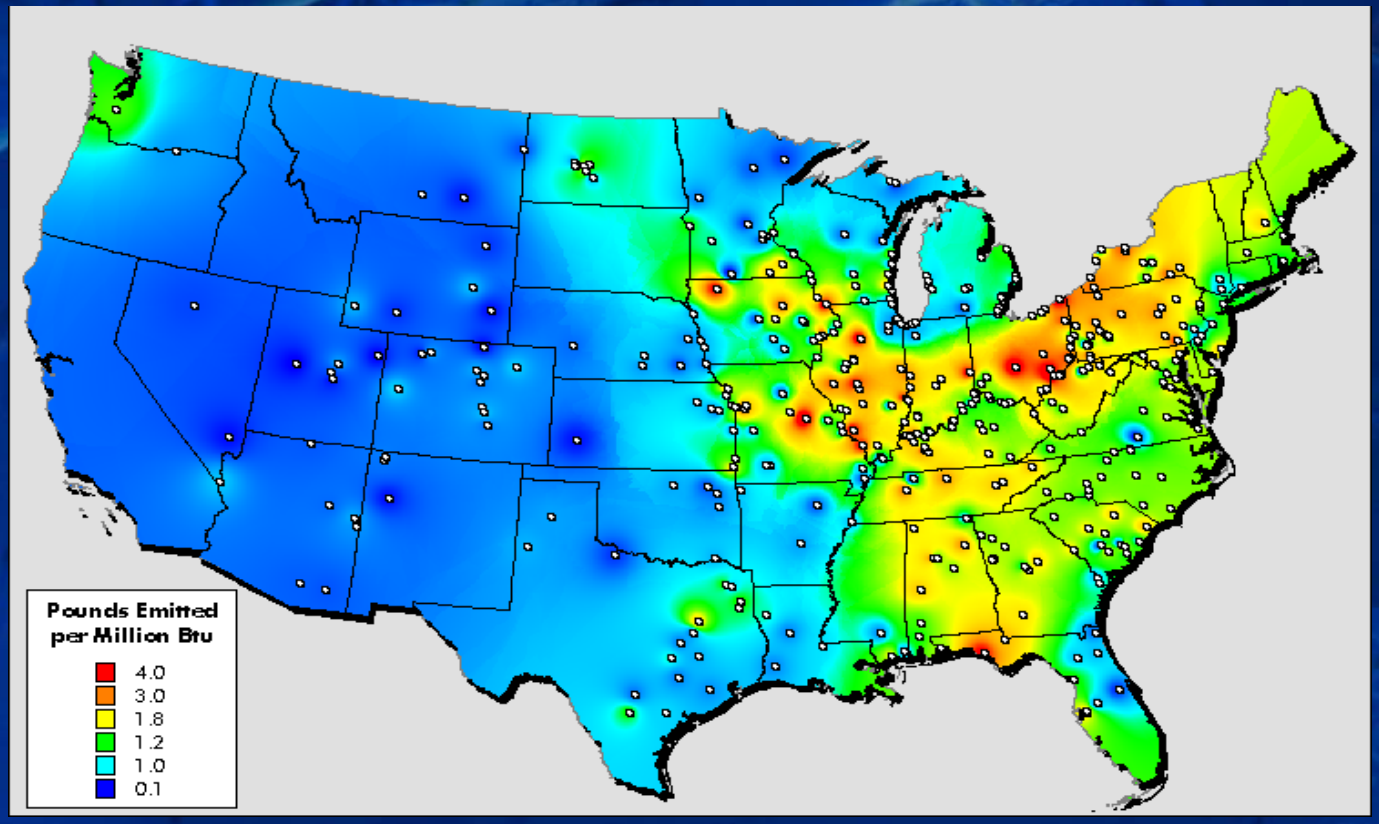
Source: UDI

Average Plant Age Of US Coal-Fired Power Plants



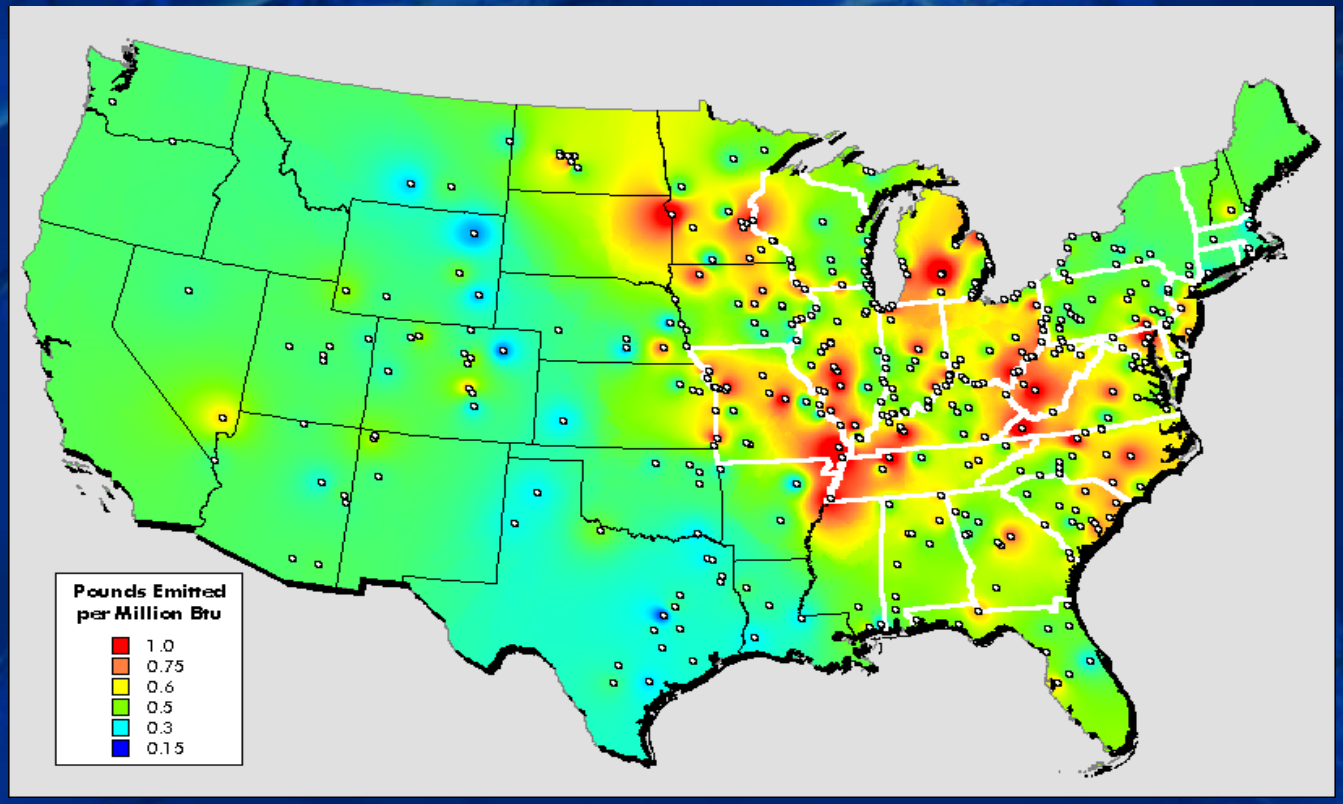
Life Extension, Repowering or New Generation

SO_2 Emission Rates For US Coal Power Plants



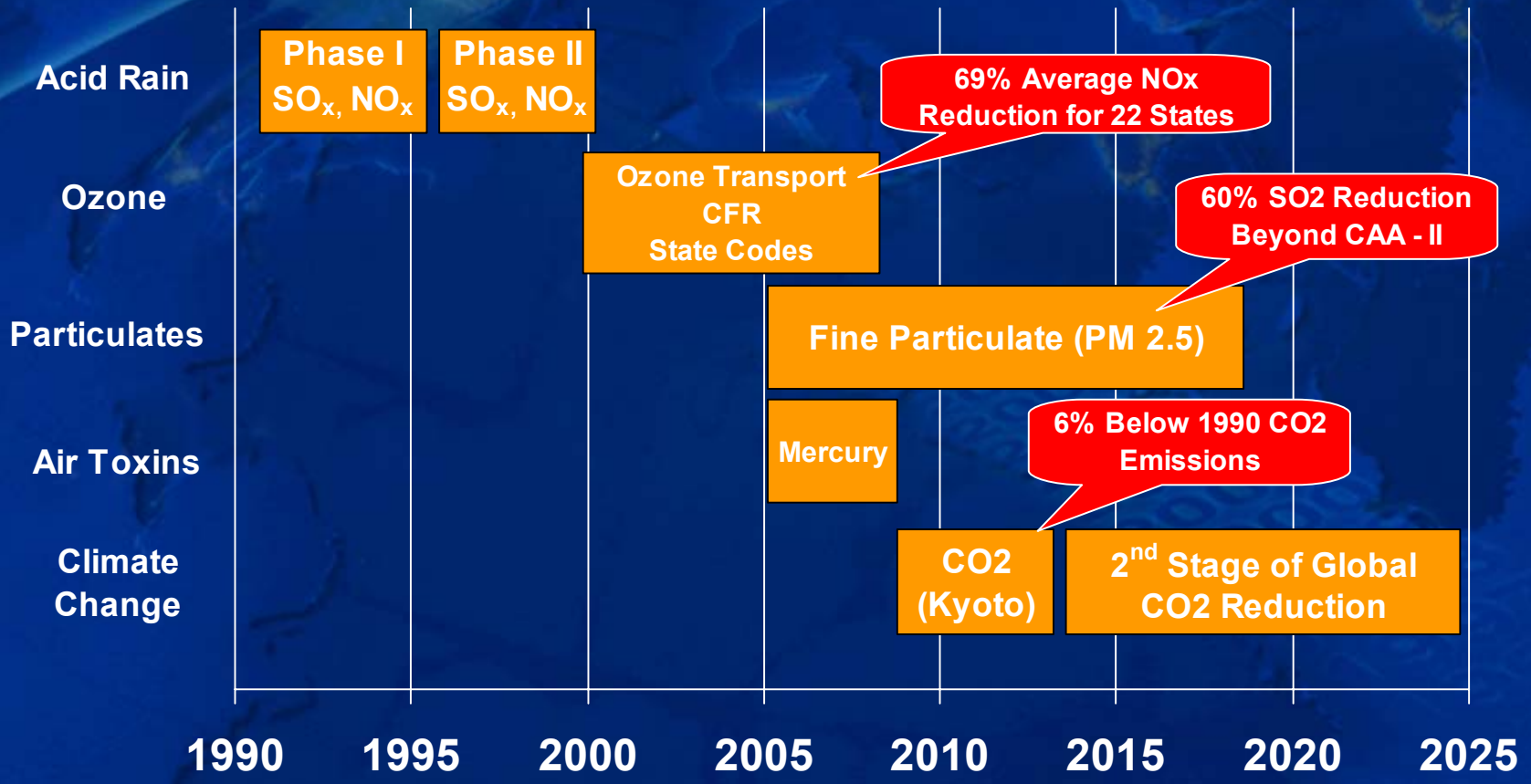
FGD Retrofits, Lime Injection or CFB

NOx Emission Rates For US Coal-Fired Plants



Low NOx Combustion, SNCR, SCR

US Emission Regulation Outlook



What are New Coal Plants Facing ?

Year	NOx	SO2	Particulate*	Mercury	CO2
	lb/MMBtu	lb/MMBtu	lb/MMBtu	% Red.	% Red.
1971 NSPS	0.7	1.2	0.1	N/A	N/A
1978 NSPS	0.5 - 0.6	0.2 - 1.2	0.03	N/A	N/A
2001 NSPS	0.15	0.2 - 1.2	0.03	N/A	N/A
2001 Proposals	0.06 - 0.1	0.06 - 0.15	0.01	40%	N/A
2010 Projection	*0.04*	*0.04*	*0.01*	*90%*	*7% below 1990?*
Research Target (ppmv@3.5% O2)	*0.02 (13)*	*0.02 (10)*	*0.005*	*95%*	*TBD*

* New $PM_{2.5}$ requirement is reflected in SO2 and NOx limits

R&D Should Focus on Achieving these Emissions

What Should be our Research Focus ?

Emissions, Emissions, Emissions !

- **Flue Gas Cleaning Technology**
- **Hg Control Technology**
- **Gasification**
- **Disruptive Technologies**
  - Clean Distributed Generation Technology
  - Energy Storage